EXPERIMENT 17 : BUOYANT FORCE AND DENSITY

PURPOSE:
Investigate the buoyant force and Archimedes principle

MATERIALS:
overflow can (for example sargent welch WL1148B) catch bucket, spring scale, 1kg, density cubes (for example arbor Product # P1-1010) , ruler, scale to 200g.

DATE_____

AUTHOR_____

PARTNER_____

PARTNER_____

BACKGROUND

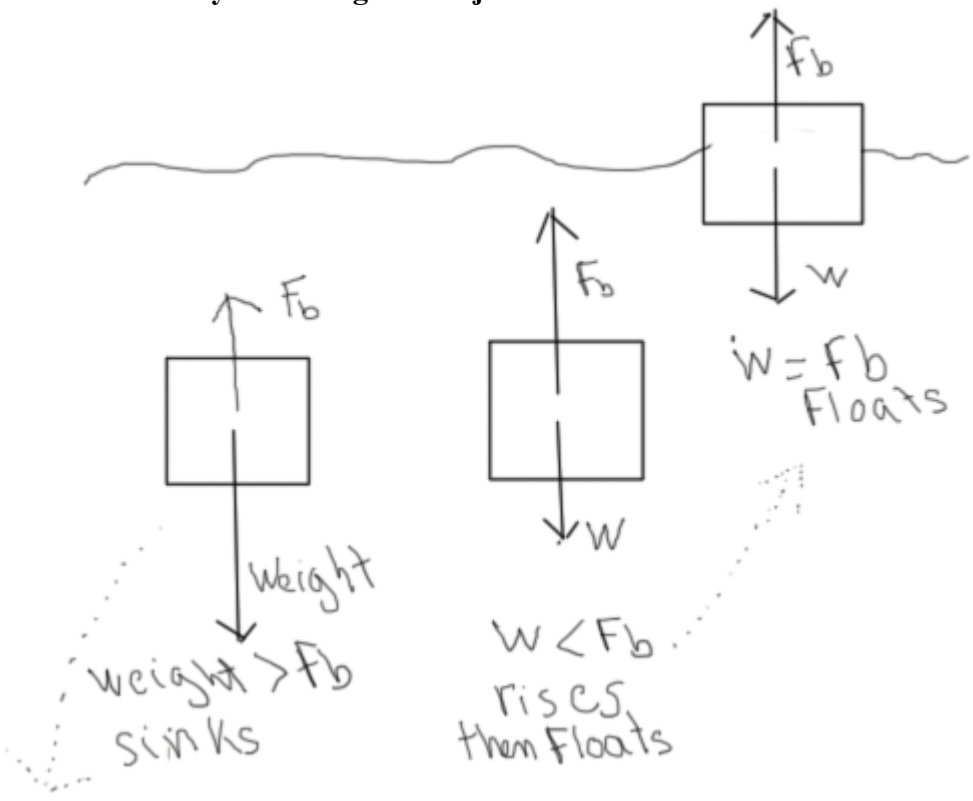
Archimedes' principle states that an object wholly or partially immersed in a fluid is buoyed up by a net force to the weight of the fluid it displaced.

Fbuoyant = Fweight of fluid displaced

Fweight of fluid displaced = density of fluid x Volume of fluid displaced x g
Weight of object = Volume of object x density of object x g

So if weight of object > Fbuoyant force that means ***density object > density fluid***.
The object sinks.

If the weight of object < Fbuoyant force that means ***density object < density fluid***.
The object rises until **Fbuoyant = weight of object.**



PART I:
You are going to verify:
Buoyant force = weight of water displaced so:

weight of object in water = weight of object in air – buoyant force

(apparent weight) (true weight) (Archimedes force)

Your object is a 1,000g mass (1kg)/

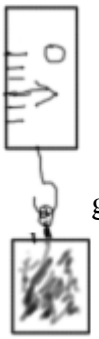
Use a spring scale and make sure the arrow is at 0.

Since weight = mass x 9.8, we will work with masses instead of weight.
The idea is the same:

mass in water = mass in air – mass of water displaced.

1) Use the spring scale to find the mass in air.

Mass in air of object = _____ grams

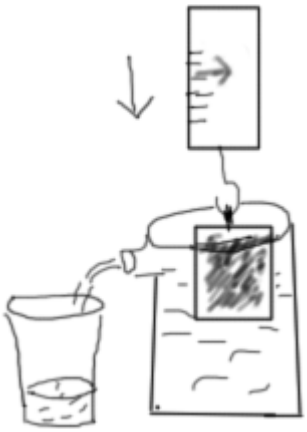


2) Use a digital scale to measure the mass of the catch bucket (the can without the sprout) in grams. Mass catch bucket = _____ grams

3) Fill the overflow can (with the sprout) with water. Fill it until water actually flows out of the sprout. (side tube).

4) Disregard the overflowed water and dry the catch bucket with a towel. DO NOT MOVE THE OVERFLOW CAN.

5) Place the catch under the spout again.
The can is full of water that is ready to spill.
Gently lower the object into the overflow can using the spring scale. The mass should not touch the bottom. The mass should be totally submerged in water.

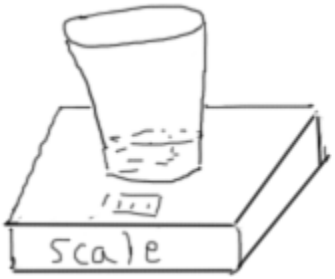


Measure the mass of the object in water:
mass object in water = _____ grams

Is the mass more or less?

5) Once the water is done over flowing, determine

the mass of the catch bucket with the water displaced in it.



Mass of catch bucket +displaced water = _____ grams.

6) What is the mass of the displaced water ?
Mass of displaced water = mass bucket + water – mass of bucket
mass displaced water = _____ grams

7) So:

mass in air of object = _____ (true mass) (1)

mass in water of object - _____ (apparent mass) (2)

buoyant force = true mass – apparent mass = _____ grams (3)

mass of displaced water = _____ grams (4)

Conclusion? According to Achimides which of these numbers are equal ?

% error =[(3) – (4)] / (3) x 100 = _____

Part II

Work with 3 tubes of different densities. You are going to compute the density and identify the cube.

1) Measure the mass volume of the cube in cm. (volume = length x width x height).
The unit is cubic centimeter. Volume = _____cm^3.

2) Measure the mass of the cube using a scale. Mass= _____g

3) Calculate the density of the cube . Density is the mass per unit volume.
Density = mass / volume. Density = _____ g/ cm^3

4) Use the table below to identify the metal. _____.

5) calculate the % error = (true – calculated) / true x100 =

6) repeat the other 2 cubes: (don't forget the units)

Volume 2 = _____ Volume 3 = _____
mass 2 = _____ mass 3 = _____
density = _____ density 3 = _____
metal = _____ metal 3 = _____
% error = _____ % error = _____

	Density (g/cm^3)
Aluminum (Al)	2.8
Zinc(Zn)	7
Iron (Fe)	7.9
Brass (Br)	8.3
Copper (Cu)	9.1
Lead (Pb)	11.6

CONCLUSION:

1) State Archimide's principle

2) What is the equation that gives the buoyant force used in the experiment ?

3) What is the condition for an object to rise in a fluid ? (see introduction).

4) How did you find the buoyant force in this experiment ?

5) How did you find the density of the cubes ?

6) What is called the apparent weight of an object?

CONCLUSION:

Was the purpose of this lab accomplished ? Why ?

(your answer to this question should show thoughtful analysis and careful, through thinking)